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SURFACE DUCT, ROUGH SURFACE SCATTERING, AND
CUSPED CAUSTIC IMPROVEMENTS FOR FACT

SAI-82-472-WA

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SURFACE DUCT, ROUGH SURFACE SCATTERING, AND
CUSPED CAUSTIC IMPROVEMENTS FOR FACT

SAI-82-472-WA

March 1981

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ABSTRACT

In September 1980 SAI was tasked to support the Tactical ASW Environmental Acoustic Support (TAEAS) project in developing Navy Standard Transmission-Loss Model (FACT) updates that incorporated several previously developed routines. Specifically the modifications addressed problems associated with surface ducts, cusped caustics, and the treatment of rough surface losses.

These modifications have been assembled and provided to NORDA 320 for distribution. The computer implementation of these improvements is briefly described in this report; complete technical documentation and test cases are included in a companion report.

SUMMARY OF FACT MODIFICATIONS

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The TAEAS Program provides environmental acoustics support to a number of Fleet commands. This support includes the development and maintenance of the tactical prediction model, ASRAP. Recently SAI has developed a set of modifications to the FACT Model (the transmission-loss component of ASRAP) to improve the treatment of surface ducts, rough surface scattering and cusped caustics. These model updates were assembled in an internally consistent form and provided to NORDA 320 under this contract. Complete technical documentation, source code listings and test cases are presented in a companion report.

Reference: Spofford, C.W., et. al., "Implementation of Rough Surface, Surface Duct and Cusped Caustic Improvements in FACT," SAI-82-471-WA (March 1981)

The three specific areas addressed by this effort are outlined below:

- (1) Rough-Surface Scattering Losses: prior to these modifications FACT assumed perfect specular reflection; specular losses as a function of frequency, grazing angle, and sea-state have been introduced.
- (2) Surface-Ducted Propagation: the Clay model has been replaced by an rms mode model with more appropriate environmental sensitivity and a more reasonable depth dependence.

- (3) Cusped Caustic Modifications: the treatment of the ray family associated with cusped caustics has been expanded to consider the possible presence of an imbedded smooth caustic.

Several major differences are observed in a review of the test cases generated by the modified version vice those obtained from the original FACT Model. Most notably these include:

- (1) Differences in Convergence zone descriptions
- (2) Sensitivity of non-ducted path to wave height
- (3) More detailed depth-dependence of surface-ducted propagation.

The net result is a more accurate propagation-loss prediction for environmental conditions that were previously either poorly treated or ignored.



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Report Number	Personal Author	Title	Publication Source (Originator)	Pub. Date	Current Availability	Class.
Unavailable	Unavailable	SELF-TENSIONING ACOUSTICAL HORIZONTAL LINE ARRAY (SPRAY) DATA ANALYSIS. FINAL REPORT OF BEARING STAKE TESTS JANUARY THRU MARCH 1977. VOLUME IVB. DATA POINTS 10, 11 AND 12 RAW DATA	Sanders Associates, Inc.	790109	ADC017579	U
ARLTR7924	Mitchell, S. K., et al.	ANALYSIS OF ACOUSTIC BOTTOM INTERACTION IN BEARING STAKE (U)	University of Texas, Applied Research Laboratories	790223	ADE001369; NS; ND	U
TIU1886502F	Eichenberger, D.	REPORT FOR CHURCH STROKE II OCEANOGRAPHIC SERVICES	Texas Instruments, Inc.	790326	ADB036751; ND	U
Unavailable	Unavailable	FINAL REPORT, 1 NOVEMBER 1976-31 DECEMBER 1978 PREMOBILIZATION OF R/V INDIAN SEAL	Xonics, Inc.	790430	ADB037987	U
Unavailable	Mitchell, T. M.	ACODAC AMBIENT NOISE PROGRAM	Texas Instruments, Inc.	790531	ADB039703	U
Unavailable	Hays, E. E.	INTRODUCTION TO THE LRAPP ENVIRONMENTAL-ACOUSTIC DATA BANK (U)	Woods Hole Oceanographic Institution	790601	ADB040404	U
LRAPPR79029	Unavailable	MEASUREMENTS ON AQUADYNE MODEL AQ-1 ELEMENTS FOR THE UPGRADED LAMBDA ARRAY	Naval Ocean R&D Activity	790601	ADB041066; NS	U
USRD NO. 4807	Unavailable	SUMMARY OF ENVIRONMENTAL ACOUSTIC DATA ANALYSIS	Naval Research Laboratory	790802	ND	U
Unavailable	Ellis, G. E.	TAP III FINAL REPORT (U)	University of Texas, Applied Research Laboratories	790814	ADA073876	U
BR U0048-9C2	Unavailable	OPTIONS, REQUIREMENTS, AND RECOMMENDATIONS FOR AN LRAPP ACOUSTIC ARRAY PERFORMANCE MODEL (U)	Bunker-Ramo Corp. Electronic Systems Division	790901	ND	U
ORUTR1245	Moses, E. J.	EVALUATION OF STANDARD OCEAN CANDIDATES ENVIRONMENTAL ACOUSTIC SUPPORT FOR FLEET OPERATIONS AND NATO	ORI, Inc.	790917	NS; ND	U
Unavailable	Colborn, J. G., et al.	SUMMARY OF ENVIRONMENTAL ACOUSTIC MEASUREMENTS, MODELING AND ANALYSIS SURFACE DUCT, ROUGH SURFACE SCATTERING, AND CUSPED CAUSTIC IMPROVEMENTS FOR FACT	Pacific-Sierra Research Corp., Science Applications, Inc.	800301	ADA087304	U
Unavailable	Kirby, W. D.	WIND-GENERATED NOISE MODELING	University of Texas, Applied Research Laboratories	801112	ADB052623	U
Unavailable	Unavailable	TOWED ARRAY PERFORMANCE PREDICTION SYSTEM - VERSION 1.2	Science Applications, Inc.	801215	ADB053770	U
3	Unavailable	FINAL REPORT	University of Texas, Applied Research Laboratories	810721	ND	U